PATENT ABSTRACTS OF JAPAN

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(54) CORROSION-RESISTANT COMPOSITE MEMBER

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain a member having high resistances to halogen-based corrosive gases or plasmas thereof and suitable for a large-sized part by forming a corrosive film comprising a rare earth oxide in a specific proportion or above and constituting a site exposed to the halogen-based corrosive gases or plasmas thereof on a support having a coefficient of thermal expansion within a specific range and a specified value or below of dielectric loss.
SOLUTION: The coefficient of thermal expansion of a support is 7×10-6 to 12×10-6 and the dielectric loss thereof is ≤×10-3. The content of a rare earth oxide in a corrosion-resistant film is ≥50 wt.%. Y2O3, Dy2O3, Er2O3 and like are cited as the rare earth oxide and Y2O3 is preferred. When two or more components of oxides are contained, a compound oxide such as Y2O3-Al2O3 is preferably roentgenologically formed. The corrosion-resistant film is formed by a thermal spraying or a sputtering method. The support is preferably alumina, zirconia or the like. Thereby, cracking or peeling of a film due to a large difference in thermal expansion or a large dielectric loss is scarcely caused even when a large-sized part is provided.

CLAIMS

[Claim(s)]
[Claim 1] The corrosion-resistant compound member characterized by having the corrosion-resistant film with which coefficient of thermal expansion constitutes the part where dielectric loss is formed on it with 5xten to three or less base material by 7x10-6 to 12x10-6, and is put to halogen system corrosion gas or those plasma, including a rare earth oxide 50% of the weight or more.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to a corrosion-resistant compound member with the high resistance over the suitable halogen system corrosion gas or the suitable halogen gas plasma for a semiconductor device production process and a liquid crystal display production process.
[0002]
[Description of the Prior Art] Many quartz glass and ceramic sintered compacts are used for the member used under the chemical corrosive high environment represented by the semiconductor device production process. As such a member, a bell jar, a chamber, a susceptor, a clamp ring, a focal ring, etc. can be mentioned, and these are used at the dry etching process by corrosive high halogen system gas, for example.
[0003] By the way, in the production process of a semiconductor device and a liquid crystal display, enlargement of a substrate is attained, the response to the very large-sized thing 1m** is demanded, and enlargement of a manufacturing installation is needed [with a semi-conductor wafer / with 300mmphi and a liquid crystal display substrate] from a viewpoint of cost reduction, in connection with this.
[0004]
[Problem(s) to be Solved by the Invention] However, in the quartz glass used conventionally, the response to large-sized components from the point of reinforcement and rigidity must be restricted. Moreover, the ununiformity of an organization represented with large-sized components manufacture of alumina ceramics by big and rough pore is a problem, and under an especially corrosive high environment, since this pore becomes a corrosion origin, we are anxious about problems, such as particle generating and acceleration of corrosion. Although there is sapphire as an especially corrosion-resistant high ingredient, also in this, there is a limit in the response to the above-mentioned large-sized components from the problem of single crystal manufacture size.
[0005] This invention is made in view of this situation, its resistance over halogen system corrosion gas or the halogen gas plasma is high, and it aims at offering the corrosion-resistant compound member which was moreover suitable for large-sized components.
[0006]
[Means for Solving the Problem] In order to solve the above-mentioned technical problem, the corrosion-resistant compound member to which this invention is characterized by coefficient of thermal expansion having the corrosion-resistant film which constitutes the part which dielectric loss is formed on it with 5xten to three or less base material by 7x10-6 to 12x10-6, and is put to halogen system corrosion gas or those plasma, including a rare earth oxide 50% of the weight or more is offered.
[0007] According to this invention, the corrosion-resistant film with which coefficient of thermal expansion is comparatively small with the film at 7x10-6 to 12x10-6, and dielectric loss contains a rare earth oxide 50% of the weight or more on it using 5xten to three or less base material is formed. Since the corrosion-resistant film is made into the part put to halogen system corrosion gas or those plasma The resistance over halogen system corrosion gas or the halogen gas plasma is high, and even when it moreover enlarges, it is hard to produce peeling of the crack and film with which a differential thermal expansion and dielectric loss originate in a large thing.

[0008]
[Embodiment of the Invention] Hereafter, this invention is explained concretely. As for the corrosion-resistant compound member of this invention, coefficient of thermal expansion has the corrosion-resistant film which constitutes the part which dielectric loss is formed on it with 5xten to three or less base material by 7x10-6 to 12x10-6, and is put to halogen system corrosion gas or those plasma, including a rare earth oxide 50% of the weight or more.
[0009] Since the ingredient which contains a rare earth oxide 50% of the weight or more has the high resistance over halogen system corrosion gas or those plasma, it constitutes the part put to halogen system corrosion gas or those plasma from film which consists of such an ingredient. Corrosion resistance is inadequate in the amount of a rare earth oxide being less than 50 % of the weight. As a rare earth oxide, Y2O3, Dy2O3, and Er2O3 grade can be mentioned. In these, Y2O3 are desirable. The corrosion-resistant film may be such rare earth oxide independent, and may contain other components. Moreover, when the oxide of two or more components is included, it is desirable to form the multiple oxide in X-ray. As such a multiple oxide, the thing of 2OY2O3-aluminum3 system is desirable, for example, can mention YAlO3, Y4aluminum 2O9, Y3aluminum 5O12 (yttrium aluminum garnet), etc.
[0010] Although the membrane formation technique used from the former, such as a spraying process and the sputtering method, can be used for it and it is not limited especially, when forming membranes by the spraying process, as for the formation approach of the corrosion-resistant film, it is desirable to fully perform the moisture purge of a raw material and membrane formation equipment under reduced pressure. Thereby, the film with little porosity can be formed.
[0011] Although especially the ingredient will not be limited if coefficient of thermal expansion is [the dielectric loss of the base material which supports the corrosion-resistant film] 5x10 to three or less in 7x10-6 to 12x10-6, ceramic sintered compacts, such as an alumina and a zirconia, are suitable. having set coefficient of thermal expansion of a base material to 7x10-6 to 12x10-6 -- this -- it is because it becomes easy to generate peeling of the film, a crack, etc. by the differential thermal expansion with the corrosion-resistant film as out of range. Moreover, it is because a base material generates heat [that more than this made dielectric loss of a base material 5x10 to three or less, and] on the occasion of an activity in a GHz band and it becomes easy to produce peeling and the crack by thermal stress between a base material and the corrosion-resistant film.
[0012] Although especially the surface roughness of the side which forms the corrosion-resistant film of a base material is not limited, it is desirable for center line average surface roughness Ra to be 2 micrometers or more. A thereby more firm junction interface can be acquired. Ra is 5 micrometers or more still more preferably.
[0013] As mentioned above, when dielectric loss forms the corrosion-resistant film which contains a rare earth oxide 50% of the weight or more on 5xten to three or less base material by 7x10-6 to 12x10-6 and coefficient of thermal expansion constitutes the part where the film is put to halogen system corrosion gas or those plasma, the resistance over halogen system corrosion gas or the halogen gas plasma is high, and the corrosion-resistant compound member which was moreover suitable for large-sized components is obtained.
[0014]
[Example] Hereafter, the example of this invention is explained. Using yttrium oxide (Y2O3) of 99.9% of purity, and the aluminum oxide (aluminum 2O3) of 99.9% or more of purity, the corrosion resistance film with a thickness of about 100

micrometers was formed on the front face of the ceramic base material of 150mm** with the plasma spraying equipment, and the compound member of No.1-5 of a table 1 was obtained. As a base material, the mullite whose coefficient of thermal expansion is 5x10-6/degree C was used by No.4 No.1, and 2, 3 and 5 using the aluminum oxide (alumina) whose coefficient of thermal expansion is 8x10-6/degree C. The base material of No.5 enlarged dielectric loss using the low purity article which contains many alkali metal as a raw material. moreover -- as the corrosion-resistant film -- No. -- 1 and 4 -- Y2O 3 -- No. -- 2 and 5 -- an yttrium aluminum garnet (YAG) and No. -- in 3, the mixture (Y2O330%) of Y2O3 and aluminum2O3 was used.
[0015] Thus, the obtained compound member was inserted in in the chamber of a parallel plate mold RIE etching system, and the corrosion trial by the plasma of CF4+O2 was performed. At that time, the mask of a part of polished surface was carried out on the polyimide tape, and the etch rate was computed by measuring the level difference of a part with a mask, and the part which is not. These results are shown in a table 1.
[0016] No. which is the example of this invention within the limits as shown in a table 1 -- the etch rate indicated the very small value to be 3 nm/min, and 1 and 2 did not cause the abnormalities of the interface of a base material and the corrosion-resistant film, either.
[0017] On the other hand, in No.3 which made rare-earth-elements (Y2O3) content of the corrosion-resistant film out of range [this invention], 8 nm/min and etching-proof nature (corrosion resistance) fell [the etch rate]. Moreover, as for No.4 from which the coefficient of thermal expansion of a base material separates from the range of this invention, the crack was checked by the interface of a base material and the corrosion-resistant film. Furthermore, as for No.5 in which the dielectric loss of a base material separates from the range of this invention, the crack was similarly checked by the interface of a base material and the corrosion-resistant film.
[0018] Next, the hemispherical dome shape-like article with a bore of 400mm which consists of an aluminum oxide (alumina) was produced, the inner surface was coated with the YAG layer by the plasma metal spray method by having made this into the base material, and the compound member assessment article of the same combination as the above-mentioned No.2 was obtained. This compound member assessment article was set in the plasma chamber, and the etching test by the plasma was performed like the above-mentioned example. Consequently, etch rates are 4 nm/min and abnormalities were not observed by the interface of a base material and resist.
[0019]
[A table 1]

[0020]
[Effect of the Invention] As explained above, according to this invention, dielectric loss by 7x10-6 to 12x10-6 5xten to three or less base material, [coefficient of thermal expansion] Since it is formed on it, the corrosion-resistant film which contains a rare earth oxide 50% of the weight or more is formed and this film constitutes the part put

to halogen system corrosion gas or those plasma The resistance over halogen system corrosion gas or the halogen gas plasma is high, and the corrosion-resistant compound member which was moreover suitable for large-sized components can be obtained.

TECHNICAL FIELD

[Field of the Invention] This invention relates to a corrosion-resistant compound member with the high resistance over the suitable halogen system corrosion gas or the suitable halogen gas plasma for a semiconductor device production process and a liquid crystal display production process.

PRIOR ART

[Description of the Prior Art] Many quartz glass and ceramic sintered compacts are used for the member used under the chemical corrosive high environment represented by the semiconductor device production process. As such a member, a bell jar, a chamber, a susceptor, a clamp ring, a focal ring, etc. can be mentioned, and these are used at the dry etching process by corrosive high halogen system gas, for example. [0003] By the way, in the production process of a semiconductor device and a liquid crystal display, enlargement of a substrate is attained, the response to the very large-sized thing 1m** is demanded, and enlargement of a manufacturing installation is needed [with a semi-conductor wafer / with 300mmphi and a liquid crystal display substrate] from a viewpoint of cost reduction, in connection with this.

EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, according to this invention, dielectric loss by 7x10-6 to 12x10-6 5xten to three or less base material, [coefficient of thermal expansion] Since it is formed on it, the corrosion-resistant film which contains a rare earth oxide 50% of the weight or more is formed and this film constitutes the part put to halogen system corrosion gas or those plasma The resistance over halogen system corrosion gas or the halogen gas plasma is high, and the corrosion-resistant compound member which was moreover suitable for large-sized components can be obtained.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, in the quartz glass used conventionally, the response to large-sized components from the point of reinforcement and rigidity must be restricted. Moreover, the ununiformity of an organization represented with large-sized components manufacture of alumina ceramics by big and rough pore is a problem, and under an especially corrosive high environment, since this pore becomes a corrosion origin, we are anxious about problems, such as particle generating and acceleration of corrosion. Although there is sapphire as an especially corrosion-resistant high ingredient, also in this, there is a limit in the response to the above-mentioned large-sized components from the problem of single crystal manufacture size.

[0005] This invention is made in view of this situation, its resistance over halogen system corrosion gas or the halogen gas plasma is high, and it aims at offering the corrosion-resistant compound member which was moreover suitable for large-sized components.

MEANS

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, the corrosion-resistant compound member to which this invention is characterized by coefficient of thermal expansion having the corrosion-resistant film which constitutes the part which dielectric loss is formed on it with 5xten to three or less base material by 7x10-6 to 12x10-6, and is put to halogen system corrosion gas or those plasma, including a rare earth oxide 50% of the weight or more is offered.
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EXAMPLE

[Example] Hereafter, the example of this invention is explained. Using yttrium oxide (Y2O3) of 99.9% of purity, and the aluminum oxide (aluminum 2O3) of 99.9% or more of purity, the corrosion resistance film with a thickness of about 100 micrometers was formed on the front face of the ceramic base material of 150mm** with the plasma spraying equipment, and the compound member of No.1-5 of a table 1 was obtained. As a base material, the mullite whose coefficient of thermal expansion is 5x10-6/degree C was used by No.4 No.1, and 2, 3 and 5 using the aluminum oxide (alumina) whose coefficient of thermal expansion is 8x10-6/degree C. The base material of No.5 enlarged dielectric loss using the low purity article which contains many alkali metal as a raw material. moreover -- as the corrosion-resistant film -- No. -- 1 and 4 -- Y2O 3 -- No. -- 2 and 5 -- an yttrium aluminum garnet (YAG) and No. -- in 3, the mixture (Y2O330%) of Y2O3 and aluminum2O3 was used.

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